Active seismic monitoring of CO2-saturated brine injection into a fault (CS-D experiment in the Mont Terri Rock Laboratory)

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Confirming the permanent containment is a key challenge for the storage of CO2 in deep underground reservoirs. Faults in the cap rock of such reservoirs are potential flow paths for the CO2 to escape. Our decametre-scale experiment at the Mont Terri Rock Laboratory aims to better understand mechanisms of CO2 leakage through a fault, and to test strategies to monitor the propagation of CO2-saturated water through faults.

Two boreholes were drilled through the main fault in Mont Terri with packer-intervals dedicated to fluid-injection and hydraulic/geochemical monitoring. Another five boreholes in the close surrounding were equipped with various instruments for geotechnical and geophysical observations. During the first phase of the experiment, the hydraulic response of the fault was characterized with injections of formation water in a step-up mode at pressures up to 6.0 MPa. The second phase, which was still on-going at the time of the abstract submission, consists of a long-term (several months) injection of CO2-saturated formation water at a constant head of 4.5 MPa, which is below the fault opening pressure. All injection activities were monitored with active seismic measurements, along with a comprehensive set of hydraulic-, mechanical-, geochemical- and other geophysical surveys. We will present the active seismic imaging results from the step-up injection test and compare them with the other surveys. Additionally, preliminary results will be shown acquired during the long-term injection of CO2-saturated formation water into the fault.
